MISSION ASSURANCE DIVISION

"Forewarned...Forearmed"

Infrastructure Decision Support for Government and Industry

NAVSEA WARFARE CENTERS DAHLGREN

Naval Surface Warfare Center
Dahlgren Division
NSWCDD

UNCLASSIFIED

Energy Security: A Path to Viable Mission Assurance

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Agenda

- Short Mission Assurance Division Introduction
- What is “Energy Security”?
- Regional Case Studies
- Metrics - Thoughts
- Conclusions

MAD's Energy Experience

- The Naval Surface Warfare Center, Dahlgren Mission Assurance Division (MAD) has been engaged in Infrastructure/ Mission Assurance (IA) since 1994.
  - Initiated as Navy Special Program - Joint Program Office and funded jointly
  - Predominately focused on CONUS infrastructures until 2002
  - Performed over 300 assessments for sponsors, ranging from the OASD(HD&ASA) to NASA
- MAD is currently tasked by the OASD(HD&ASA).
  - Develop and perform "case studies" of DoD energy security
  - Provide program management of the DoD Industrial Control Systems (ICS) Mitigation Program – also know as "Aurora"
  - Support the OASD(HD&ASA) Electric Grid Security Executive Council
- Support to Defense Science Board Task Force on DoD Energy Security
  - Provided technical support to Task Force Policy Panel
  - Prepared overview of US grid and examples of DoD dependencies.
  - Supported writing of unclassified and classified reports – "More Fight; Less Fuel".

Energy Infrastructure Issues

- Electric Power – "The Grid"
  - Limited Resiliency in Electric Power Grid
  - Complex Interdependencies – Virtually Every Aspect of Society Depends on Electric Power
  - **Most** DoD Missions/Activities Are Energy-dependent
- Electric Power Infrastructure Is Soft Target With Numerous Vulnerabilities
  - Physical Attacks (e.g., Transformer Destruction/Damage)
    - Minimal Input – a Bullet – Can Achieve Maximum Effect – Transformer Destruction
    - Insufficient Back-up Transformer Availability to Respond to Large-scale Attack
  - Electromagnetic Pulse (EMP)
  - Cyber Attacks
- Prevention Possible, but Very CHALLENGING
  - Short-, Medium-, and Long-term Mitigation Options Available
  - Continued Testing/Research Required to Fully Understand Risks/Vulnerabilities
  - "Aurora" mitigation tested and ready for installation

Regardless of the threat, vulnerabilities exist

Energy Security – Electric Power Case Studies

- Objectives
  - Support development of an OASD (HD&ASA) Mission Assurance Strategy
  - Assist DoD policy development by identifying areas of unacceptable vulnerabilities resulting from DoD mission dependencies on the commercial power grid – including Industrial Control System (ICS) vulnerabilities
  - Work with DoD, other USG, commercial power grid owners and other stakeholders to develop solutions to unacceptable grid vulnerabilities
- Goal
  - Assist in the development of coherent and technically relevant Electric Grid Security policy

Essential Elements of Energy Security

Energy Security = Reliability + Affordability

Reliability

- Availability
- Adequacy
- Delivery
- Diversity
- Sustainability

Affordability

- Economic Efficiency
- Economic Flexibility
- Environmental Acceptability
- Political Orientation
- Political Stability
- Supplier Concentration
- Supply-Demand

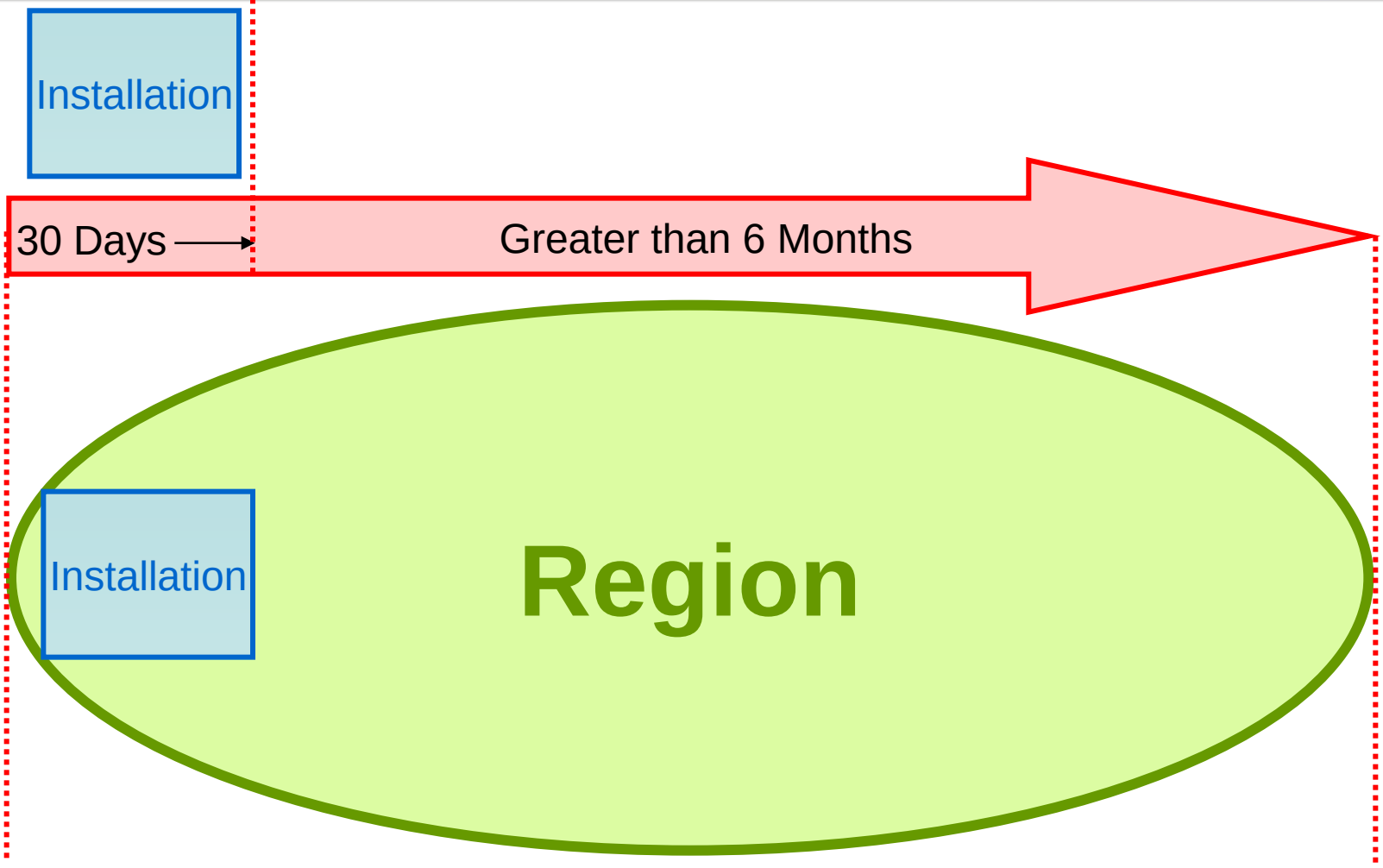
Resilience

Energy Security Implementation Requires Both Reliability and Affordability

Benefits of Regional Case Study Approach

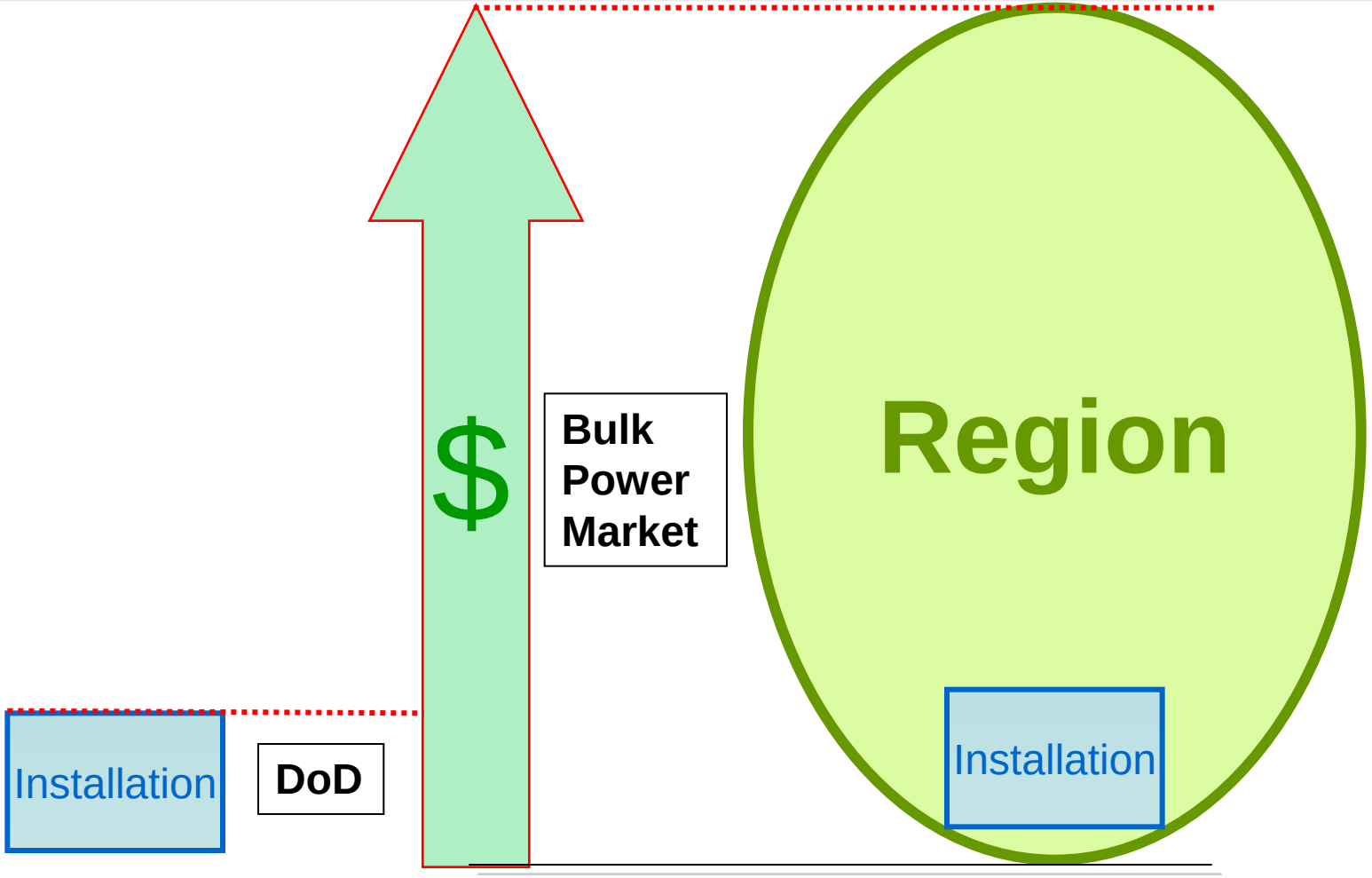
- Reliability
  - Increased generation and fuel diversity
    - Integrate commercial and DoD generation
    - Ready integration of renewable technologies
  - Ability to sustain power for 6 months or more
  - Improved redundancy in power delivery network
  - Potential to reduce transmission congestion and strengthen grid by introducing distributed generation
  - Enhanced Industrial Control Systems Security
    - Life-cycle security
    - Security certification by independent party
- Affordability
  - Grid improvements paid from revenues obtained from electric sales to the bulk power market
  - Partner with local utility, generation developers, regional transmission operator, public utilities commission and other stakeholders to ensure all customers have fair electric rates
  - Reducing transmission congestion lowers electric rates for all customers

Reliability



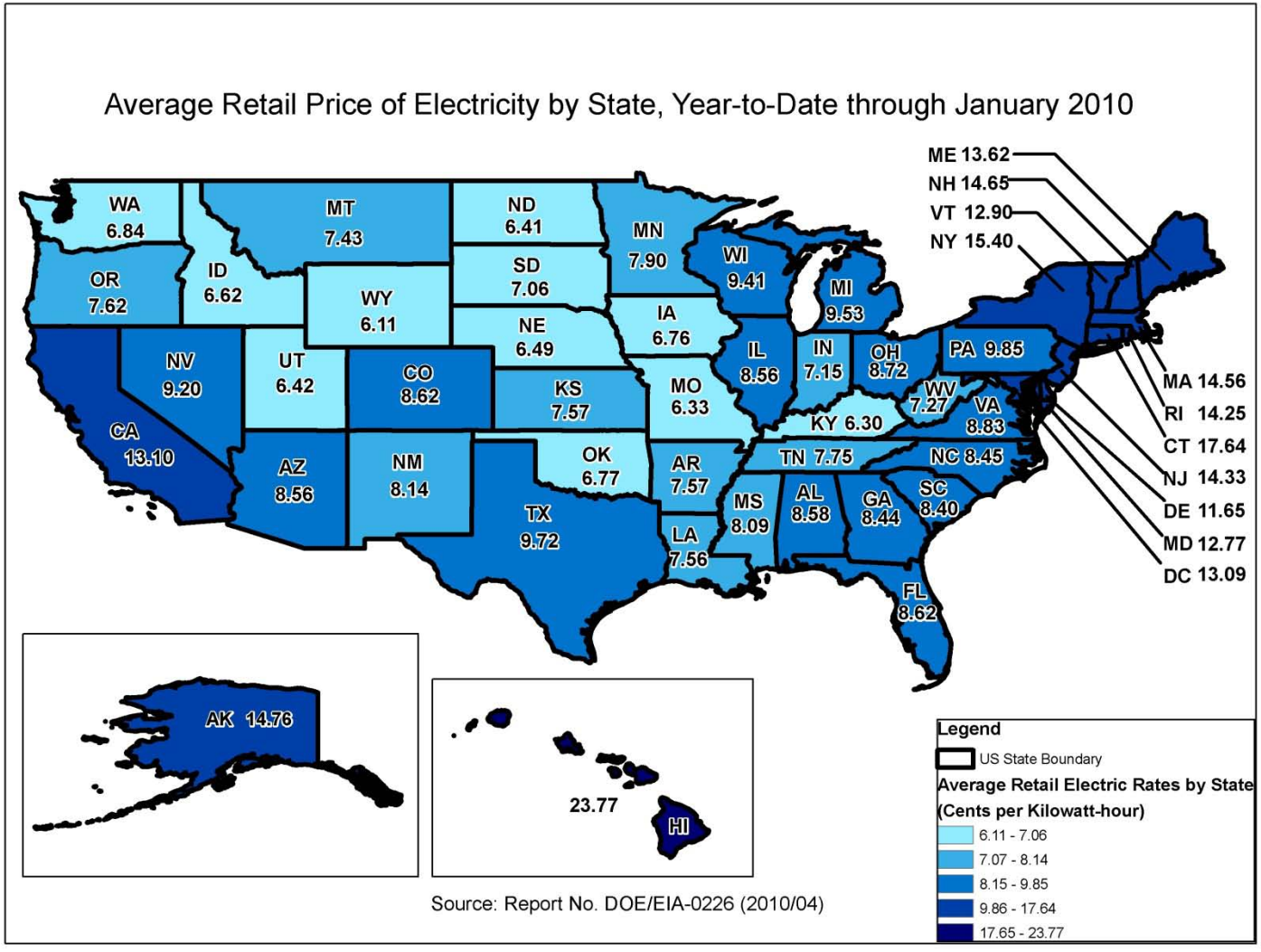
LONG TERM reliability can be too challenging for all installations

Affordability

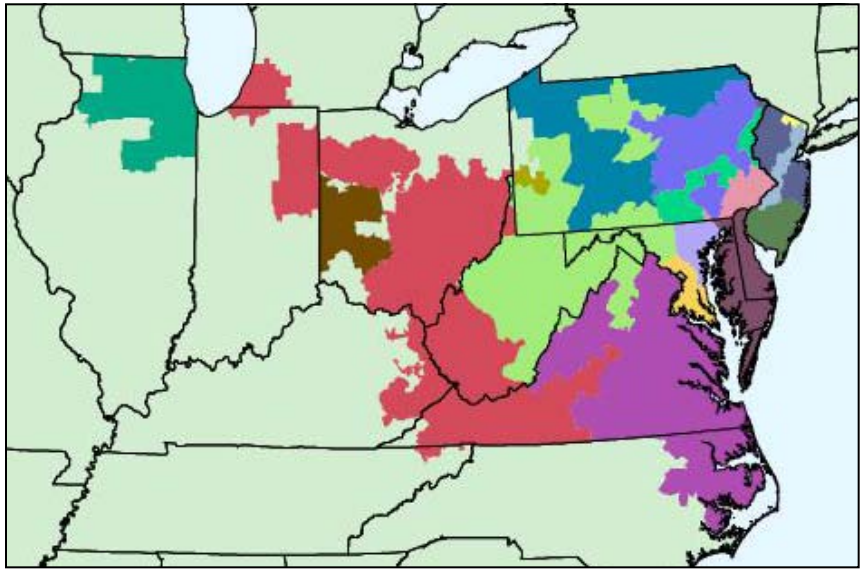


Low Cost Local Generation = Lower Rates for Local Customers

Average Retail Electric Rates



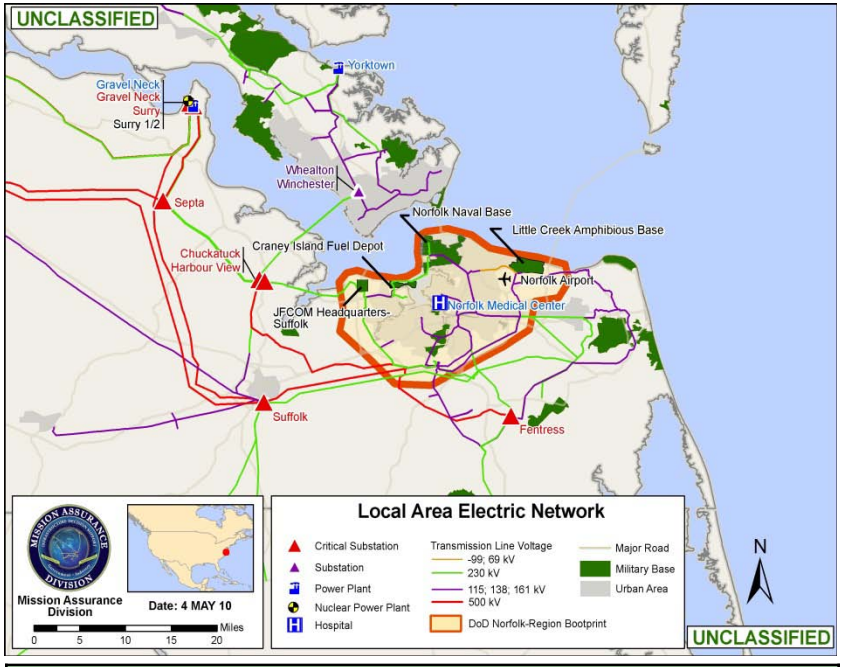
Regional Transmission Operators - PJM Example



- Regional transmission organization (RTO) is an independent grid operator
  - Operates the transmission system
  - Accommodates bulk power transactions
  - Covers all or parts of 13 States and DC
- Electric System
  - 163,500 MW of generation capacity
  - 56,350 miles of transmission lines

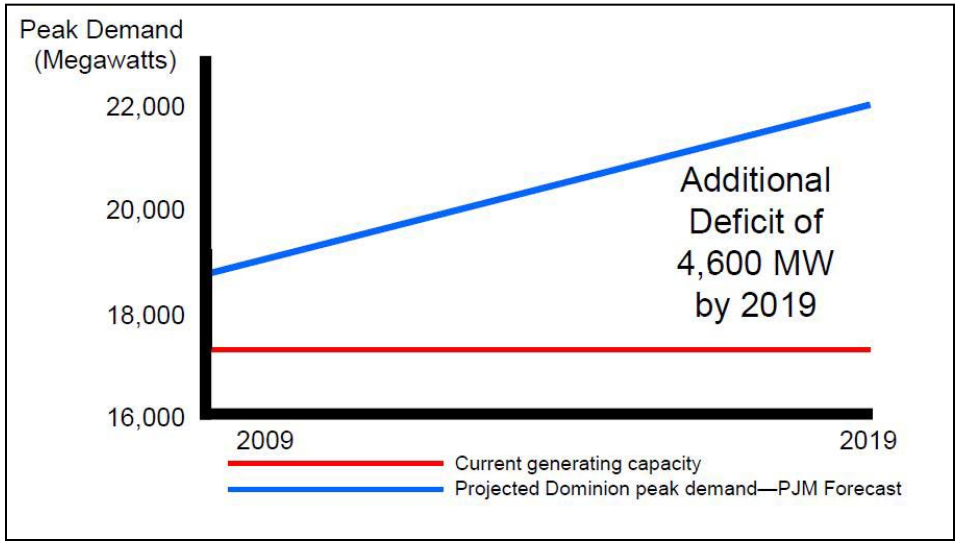
Generation Capacity Mix		
Coal	40.4%	67,065 MW
Natural Gas	29.2%	48,340 MW
Nuclear	18.3%	30,468 MW
Oil	6.5%	10,715 MW
Hydro	4.4%	7,476 MW
Wind	0.8%	1,278 MW
Solid Waste	0.4%	665 MW

Dominion Virginia Power Overview



- Serves 2.3 million customers
- 18,000 MW for Virginia
- 20% of power is imported

Dominion Virginia Power 2008 Electric Capacity by Fuel		
Coal	25%	4,500 MW
Natural Gas	21%	3,780 MW
Nuclear	14%	2,520 MW
Oil	10%	1,800 MW
Hydro / Other	10%	1,800 MW
Imported	20%	3,600 MW



Reliability Metrics - Thoughts

- Reliability = Dependable, Steadfast. Not prone to random failure.
  - Mean Time Between Failure (MTBF)
  - % Up or Down-Time
  - Can be applied to:
    - System
    - Local Networks
    - Components
  - Ability to sustain (100% availability) required power for:
    - 1 week (24/7
    - 1 month (24/7)
    - 6 months or more
- Resiliency = Ability of system to bend, but not break, under pressure
- Robustness = Strength, Sturdiness
  - Meets standards (NIST, etc)
  - Ability Integrate commercial and DoD generation
  - Ready integration of renewable technologies
- Enhanced Industrial Control Systems Security
  - Life-cycle security
    - Security certification by independent party

Affordability Metrics - Thoughts

- Affordability Metrics
  - Grid improvements paid from revenues obtained from electric sales to the bulk power market
    - Cost per kW/hr under current contract vs negotiated cost
    - Total unit cost of power sold for local utility use
    - Total unit cost of power used by local DoD customer
      - Power generated by “Prime Power” generator in lieu of “backup” generator
      - Power generated by on base renewables vs commercial power
  - Partner with local utility, generation developers, regional transmission operator, public utilities commission and other stakeholders to ensure all customers have fair electric rates
    - Delta between pre- and post- islanded generation kW/hr costs (if any)
    - Annualized reduction in total installation electric power, and associated, costs
  - Reducing transmission congestion lowers electric rates for all customers
    - Cost savings to local utility or transmission operator in congestion charges applied as rebate to negotiated rates
    - Cost savings in construction, when on base, to EP transmission connectivity

Energy Security Conclusions

- DoD dependency on the commercial power grid represents a critical asymmetric vulnerability that must be mitigated in partnership with industry.
  - Therefore, DoD can pursue a wide range of potential solutions through the case study effort to mitigate critical energy dependency.
    - Maximize commercial utilities/industry interests to produce energy with reasonable return on investments.
    - Use USG/DoD property to entice utilities to produce energy in close proximity to our mission needs.
    - Secure generation for relevant DoD and national missions to self-sustain for 6 months or more.
    - Embrace local alternative fuels technologies to fuel local generation.
    - Use these prototypes to increase positive working relationships with relevant regulatory agencies; e.g., FERC.
    - Tailor each solution based on a portfolio of generation, power delivery, and smart grid technologies that have proven track records and are new and innovative.

Presenter contact information;

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